JPL

Optical Communications at JPL

K.Wilson

Outline

JPL

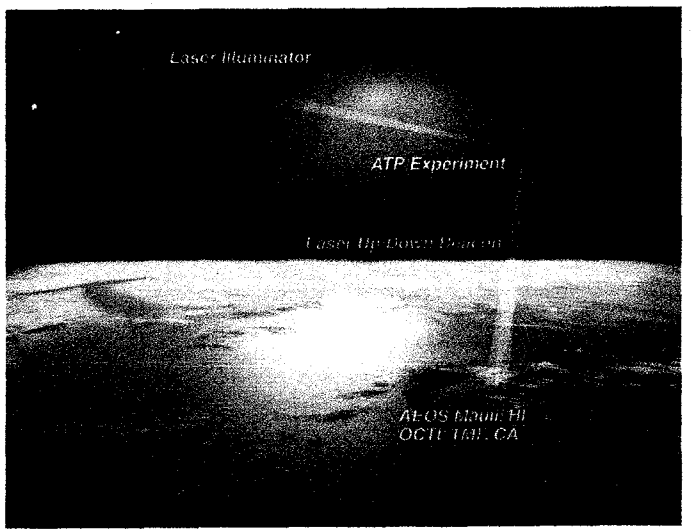
- JPL programs
  - Past
    - Multi-bit per photon
    - GOPEX demonstration
    - GOLD demonstration
    - STRV-2 demonstration
  - Present
    - ST-6 ATP Phase A study
    - 10-m deep space receiver study
    - 1-m Optical Communications Telescope Laboratory development
    - High efficiency Mbps deep space laser
  - Future
    - AIST ground demonstration of LEO–GEO communications strategies
    - Air to ground demonstrations
      - DC-8 to ground
      - Global Hawk to ground with JPL Optical Communications Demonstrator EM
  - Summary

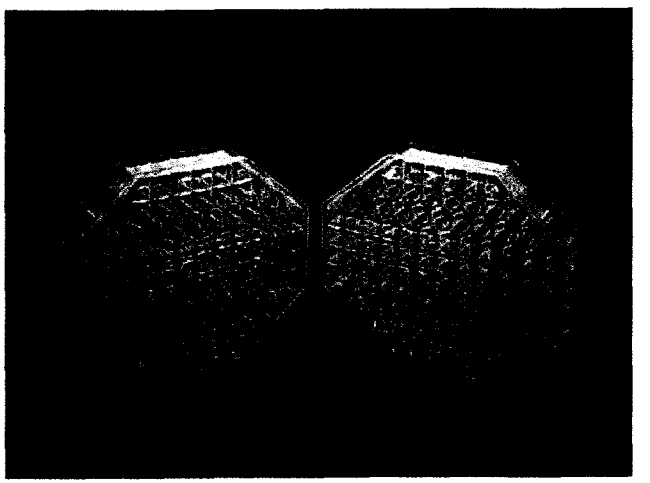
Past demonstrations

- JPS has performed both technology and system level optical communications demonstrations for near-Earth and deep-space links
  - 1982=> Demonstrated first multi-bit/photon optical communications link using pulse position modulation
  - 1992 => Demonstrated first optical link to deep space
  - 1994 => Demonstrated with SOR adaptive optics plink to lunar retro-reflectors
  - 1995 - 1996 => Demonstrated 1 Mbps bi-directional link to Japanese ETS-VI satellite at apogee of GTO
  - 2000=> Worked with AstroTerra Corp on optical link to STRV-2 lasercom terminal on TSX-5 satellite
    - Unexpectedly large errors n ephemeris precluded acquisition and tracking of s/c
    - Failure of lasercom terminal's computer caused early termination of experiment

Optical communications developments

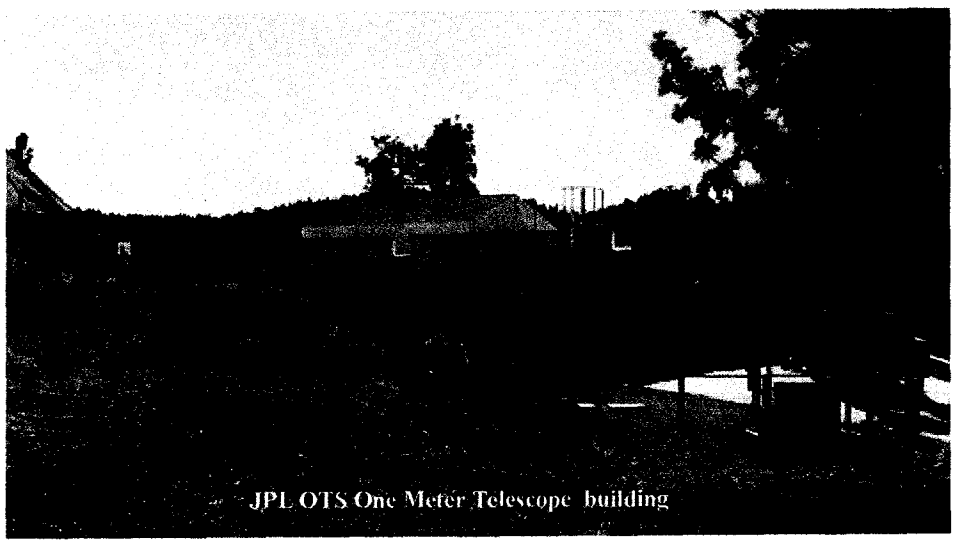
- **Ball/ JPL team is currently working on New Millennium Phase A study**
  - **Will assess and validate readiness of Acquisition, Tracking and Pointing technology for deep space optical communications missions**
- **JPL is currently studying the cost drivers for a 10-m class 100X diffraction-limited ground-based telescope for deep space-to-ground optical link.**

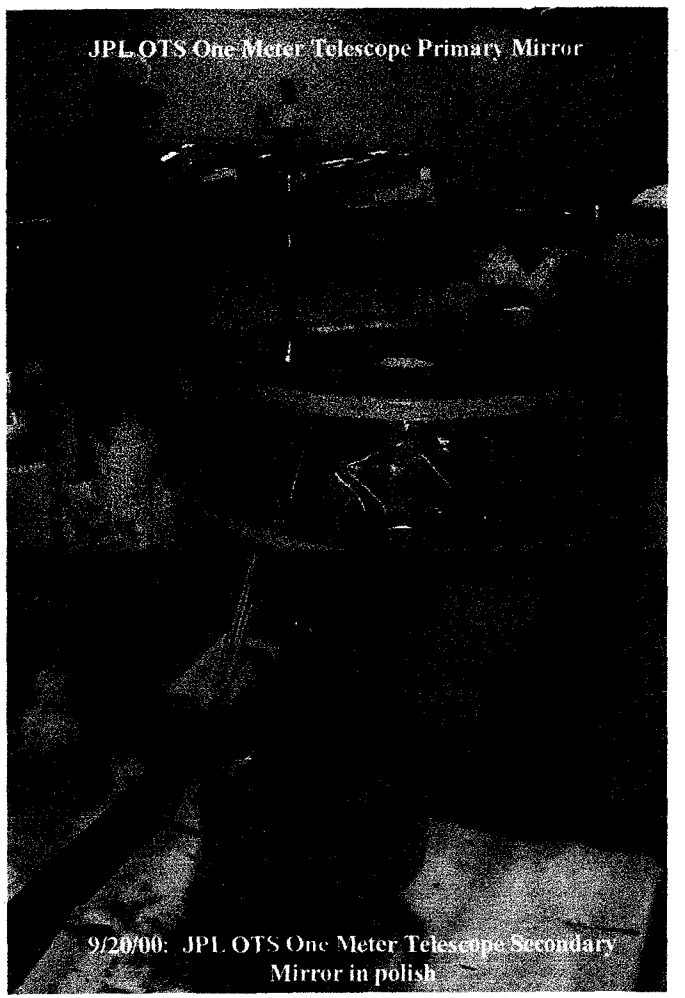




1-m Optical Telescope

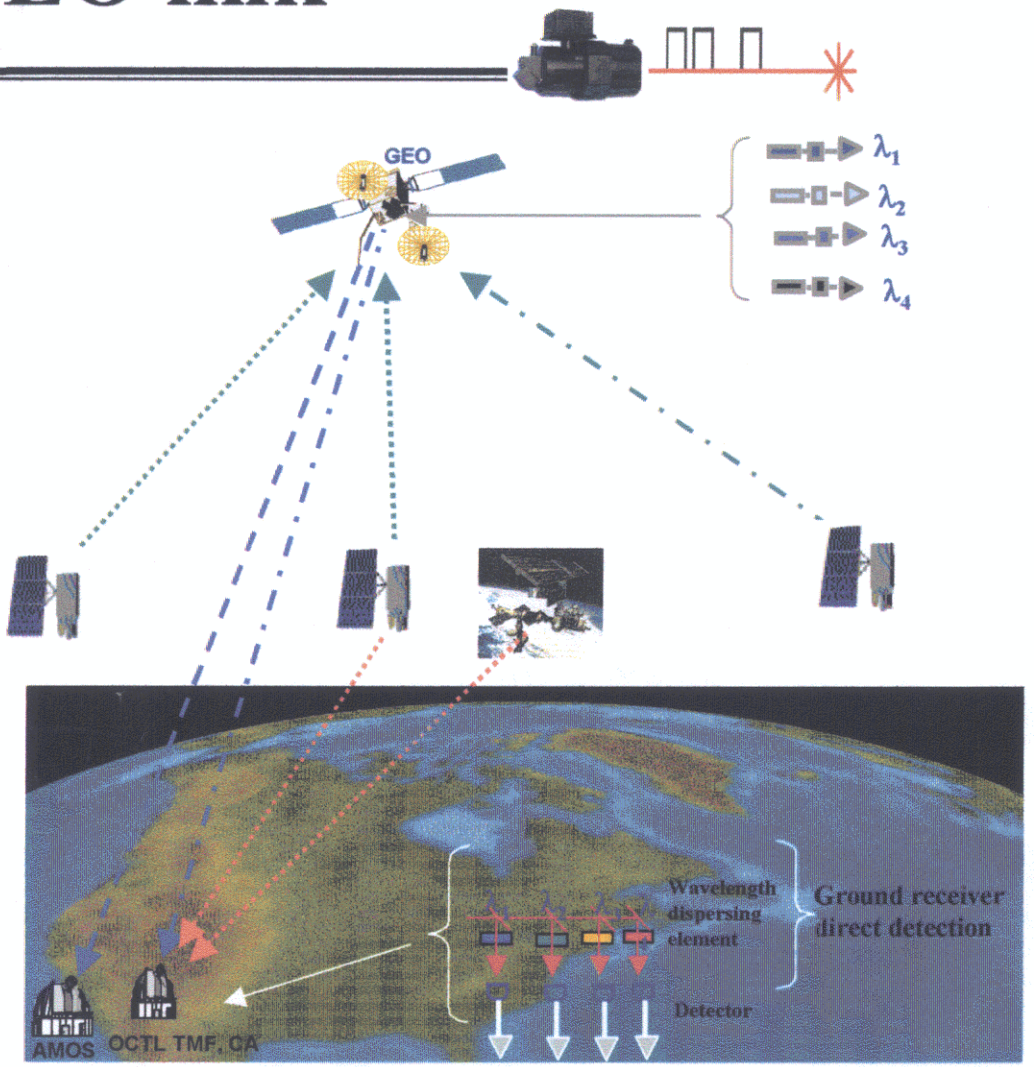
- **JPL 1-m telescope is scheduled for delivery in November**
  - **First light expected by December 2001**





LEO-GEO link

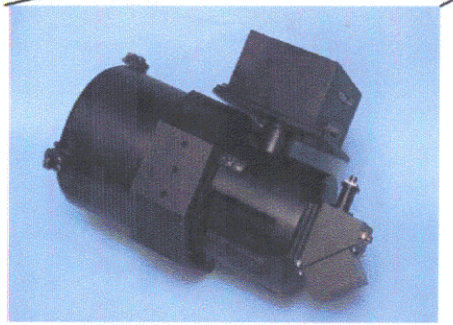
- JPL currently plans to demonstrate of multi-gigabit ground-to-ground optical communications link using LEO-GEO architecture
  - Demonstration is a first step towards a multi-gigabit LEO-GEO and GEO to ground demonstration to support data return from future NASA advanced high data rate space platforms



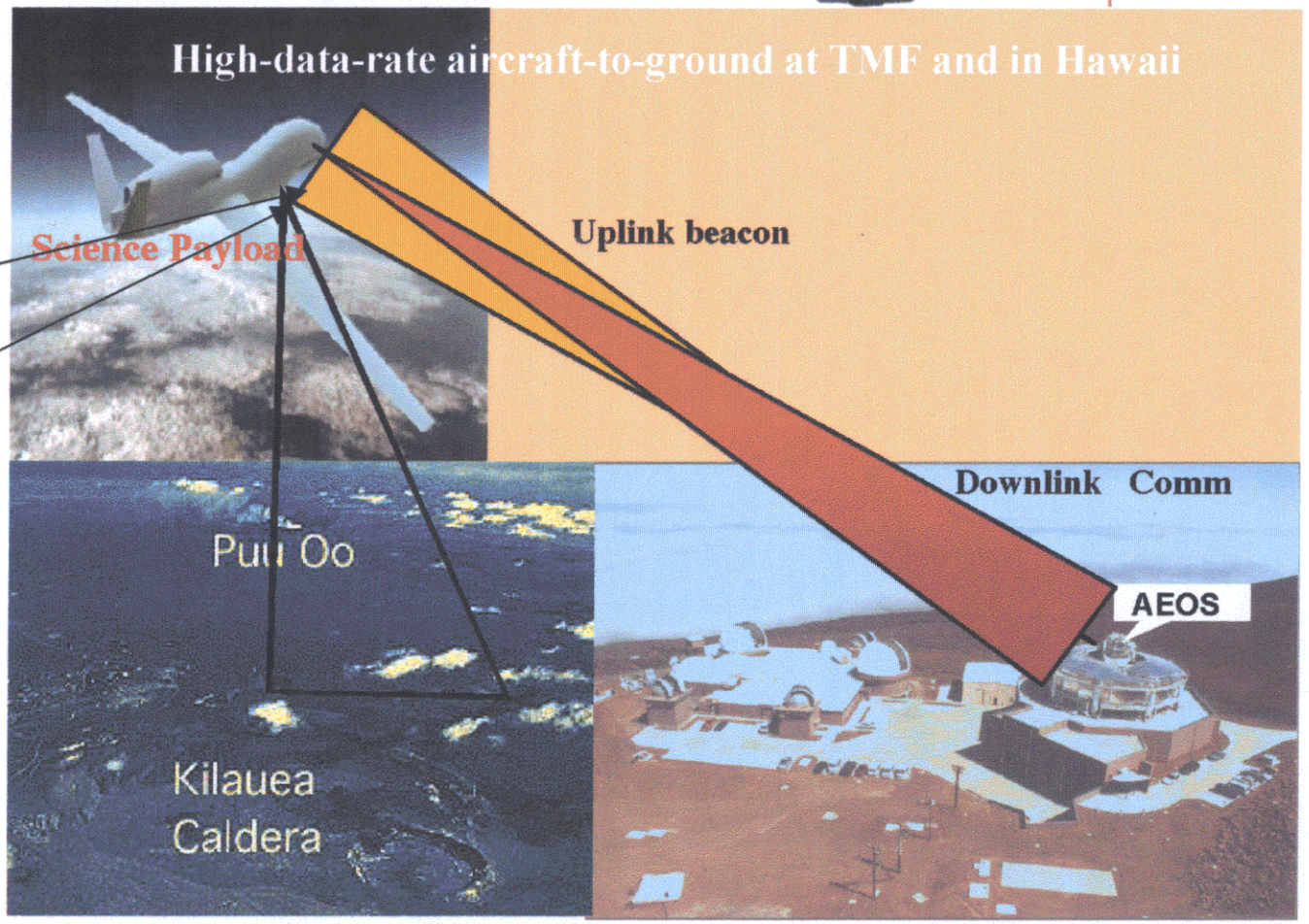
Future Air-to-ground demonstrations

Phase –1
TREX-JPL DC-8-to-ground demonstration

Phase-2
JPL UAV-to-ground demo



JPL Optical demonstrator terminal for UAV demonstration



High data-rate laser

- JPL is working with HRL to develop a multi-Watt high-efficiency laser to support Mbps links from deep space
  - Breadboard is expected to be developed by 2003

Summary

JPL

- JPL has developed a robust optical communications program over the years and has demonstrated optical links to both deep space and near-Earth probes
- Current thrusts include
  - Development of a 1-m Optical Communications Telescope Laboratory
  - Studies of low-cost 10-m deep space receiver telescope
- Future plans call for
  - Demonstration of aircraft-to-ground links
  - Validation of acquisition tracking and pointing for deep space optical communications
  - Demonstration of multi-gigabit link using LEO-GEO optical communications architecture
  - Development of high-efficiency Mbps lasers for future deep space links